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Electric and Hybrid Vehicle Research, Development and Demonstration Program Performance Standards for Demonstrations

DEPARTMENT OF ENERGY

Office of Conservation and Solar Energy

10 CFR Part 475

[Docket No. CAS-RM-79-201]

Electric and Hybrid Vehicle Research, Development and Demonstration Program Performance Standards for Demonstrations

AGENCY: Department of Energy.

ACTION: Final rule.

SUMMARY: This rule prescribes amendments to the minimum performance standards for electric and hybrid vehicles to be purchased or leased in fulfillment of contracts entered into following the effective date of these amendments for the demonstration program required under the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976. The full text of Part 475, as amended, is set forth in this final rule.

EFFECTIVE DATE: March 13, 1980.

FOR FURTHER INFORMATION CONTACT:

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SUPPLEMENTARY INFORMATION:

I. Background

On August 29, 1979, the Department of Energy (DOE) issued proposed amendments (44 FR 52140, September 6, 1979) to revise the minimum performance standards for electric and hybrid vehicles to be purchased or leased for the demonstration program required under section 4 of the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976 (Pub. L. 94-413) (Act). The proposed amendment followed an earlier Notice of Inquiry regarding amendments to the performance standards issued on March 3, 1979 (44 FR 12685, March 8, 1979). A public hearing on the proposed regulations was held on October 16, 1979. Two persons made oral presentations at this hearing. In addition, DOE has received nine written comments on the proposed standards.

II. Discussion of Comments

A number of comments endorsed the performance standards as proposed, while some comments requested more stringent standards to permit utilization of vehicles in more demanding circumstances. Still other comments expressed the view that the proposed changes were too stringent and would hamper commercialization of electric and hybrid vehicles by causing increased costs and loss of market opportunities for limited-use vehicles. The comments and DOE's response to them are discussed below.

1. *General—Permit temporary exemptions from specific portions of the performance standards.* A suggestion was made that the final rules incorporate means to grant temporary exemptions from specific portions of the performance standards to permit incorporation of developing technologies. The commenter suggested an example of incorporating batteries which are currently being developed into a vehicle, provided a manufacturer could obtain temporary exemptions from the standards applicable to battery life.

DOE does not accept this suggestion. As developing technologies lead to apparent improvements, these improvements should be verified by engineering tests and evaluation prior to incorporation into the highly visible DOE market demonstration. Demonstrating vehicles which may have poor reliability and unsatisfactory performance with continued use would not be responsive to the purpose of the Act which is to facilitate the introduction of electric and hybrid vehicles to the public.

2. *General—Develop performance requirements for limited-use vehicles which are not intended for public highway use.* A comment suggested that the performance standards should address "limited-use vehicles" not intended for use on public highways. Limited-use electric vehicles are well established products in numberous nonhighway applications. As provoded in section 2(b)(2) of the Act, DOE is to demonstrate the practicability of electric and hybrid vehicles for "personal and commercial use in urban areas and for agricultural and personal use in rural areas". Clearly, the intent of the Act is that vehicles which meet the performance standards and participate in the demonstration program will be used on public highways. Accordingly, DOE does not accept this suggested change.

3. *General—Effective date of standards.* A comment stated that the revised standards should not apply to those vehicles which are already being built under existing contacts under the demonstration program. This is the intention of DOE and the following statement has been included in the introductory paragraphs of sections 475.10 and 475.11 to eliminate any misunderstanding. "The following minimum levels of performance are required with respect to any personal-use/commercial vehicles purchased or leased in fulfillment of contracts entered into following the effective date of these regulations pursuant to section 7(c) of the Act."

4. *Section 475.2 Definitions—Hybrid vehicle.* A comment stated the present definition of "hybrid vehicle" excludes a series hybrid, that is a hybrid in which all non-electrical propulsion energy is converted to electrical energy before being used to propel the vehicle. The definition of hybrid included in the performance standards is provided in the Act. DOE has determined that series hybrid vehicles are not excluded by this definition.

5. *Section 475.2 Definitions—Vital accessories.* A suggestion was made that, for vehicles with a comfort heater, a minimum performance standard should be provided either for the heater or for vehicle performance with the heater in the "On" position. Comfort heaters should supply heat throughout the vehicle range and not degrade vehicle capability below the levels of the standards. However, comfort heaters are generally not powered from the propulsion batteries and do not affect vehicle acceleration and speed capabilities by being turned "On". Even in the event that such heaters were so powered, the major effect on vehicle performance would be reduced range due to the small, but sustained, additional power requirement. While DOE believes this change would correct an oversight in the initial performance standards, DOE has determined that such an amendment will not affect any vehicles available to the demonstration in the near future. Accordingly, DOE will consider the inclusion of this provision in its next revision to the performance standards.

6. *Section 475.10(a) and 476.11(a)—Acceleration.* Two comments requested relaxing the proposed acceleration standards, two comments suggested tightening these standards, and two comments supported the acceleration standards as proposed. After considering these comments, DOE has determined that the proposed acceleration standards appropriately reflect the state of technology which will be available in 1980 for inclusion by vehicle manufacturers into market demonstration vehicles with reasonable cost and utility. No new information or data was submitted with the comments which has not been previously considered by the DOE.

One comment stated that an industry announcement of recent improvements in zinc/nickel oxide batteries supports

more stringent performance standards. DOE is actively funding industry development of zinc/nickel oxide and other battery technologies and is also aware of other industry efforts to improve batteries for electric vehicles. The present state of development of zinc/nickel oxide battery technology is considered by DOE to be inadequate to assure sufficient availability of batteries with acceptable durability and cost to justify establishing minimum performance standards which would require these batteries in all vehicles in the DOE demonstration.

Two comments opposed dropping the acceleration standards for commercial vehicles with a payload capacity over 600 kg. DOE does not concur with this recommendation. These larger vehicles will have substantial acceleration capabilities since they must still be able to comply with the performance standards for gradeability and speed capability. Large conventional, petroleum fueled commercial vehicles also do not have the acceleration capability of personal vehicles or small commercial vehicles. Drivers are well aware of the widely different and lower acceleration capabilities of the many variations of large and highly visible conventional commercial vehicles. Therefore, lack of an acceleration standard for large electric or hybrid vehicles which meet the applicable performance standards will not create an undue hazard or inhibit the demonstration of the practicality of electric and hybrid vehicles for commercial use. The standards as issued should encourage design of these larger electric vehicles for realistic performance and utility.

7. *Section 475.10(d) and 475.11(d)—forward speed capability.* A comment recommended raising the forward speed capability standards to 96 km/h to permit some freeway driving and greater accident avoidance capabilities. No data were offered to support the implied claim of increased safety due to the higher suggested speed capability in excess of the legal speed limit. For the expected user of the major portion of the demonstration vehicles, such additional speed capability is not generally desirable (little freeway driving) in view of the probable necessary tradeoff with range and acceleration capabilities. The proposed speed capability standard is considered by DOE to be appropriate and preserves flexibility for design tradeoffs by the vehicle manufacturers. Demonstration site operators who determine that their intended use of vehicles requires greater speed capability can set such conditions in contracting for vehicles.

Another comment recommended including test procedures in this section to enable generation of comparative data. DOE considers the test conditions and procedures developed by the Society of Automotive Engineers and included in the standards in section 475.3 to be adequate to enable generation of comparative speed data. Based on past experience with the program, DOE considers the suggested procedures to be unnecessary.

8. *Section 475.10(3) and 475.11(3)—Range.* Two comments recommended that the range standard be modified to permit an additional 2-hour battery recharge to achieve the ranges specified in the proposed standards. Such a range standard is considered by DOE to be below the current state of the art as well as below user expectations and would be contrary to the intent of the DOE demonstration. Therefore, DOE does not accept this recommendation.

Another comment suggested a more stringent range standard on the basis of an industry announcement of improvements in zinc/nickel oxide battery technology. This argument is not accepted by DOE for the reasons of cost, availability and level of development as discussed in (6) above.

A comment was also received suggesting that to prolong battery life the range standard should be specified as a range to be used for occasional trips only. The DOE does not consider it advisable to enlarge the scope of the standards to regulate vehicle use and does not accept this comment. However, DOE does consider it important that the vehicle manufacturers inform vehicle users on proper vehicle use and maintenance to achieve satisfactory vehicle performance as provided in §§ 475.10(m) and 475.11(m).

A comment suggested that the range standard for commercial electric vehicles be set at 55 km on the SAE J227 a/C cycle rather than the proposed standard of 60 km on the less stringent SAE J227 a/B cycle. DOE considers the proposed "B" driving cycle with its lower cruise speed of 32 km/h compared to 48 km/h for the "C" cycle and more frequent stops to be more representative of the low speed stop-and-go service many of the 1980 commercial electric vehicles will experience, and on this cycle the proposed range of 60 km is appropriate for the state of technology available.

9. *Section 475.10(g) and 475.11(g)—Recharge control.* The recommendation was made that these standards apply to off-board chargers as well as on-board chargers. DOE agrees with this recommendation for those off-board chargers supplied by or specified by the vehicle manufacturer for recharge of the vehicle. The standard has been modified to clarify this point.

10. *Section 475.10(i) and 475.11(i)—Battery life.* A comment suggested that the acceleration and gradeability required as a function of battery life be lowered to 75 percent of the current level of the standards. DOE believes that such a relaxation would put the standards below the level of current technology and user expectations and would be contrary to the intention of the Act to demonstrate marketability and practicability of electric and hybrid vehicles.

A comment was also received recommending increasing the duration during which the vehicle must meet the specified performance. While DOE also recognizes the desirability of maintaining vehicle performance over a longer service life, it considers such a change in the standards to be premature at this time due to lack of applicable data indicating such performance would be achievable with the current state of the art. Vehicles have not been tested in the DOE demonstration for a long enough duration to provide an adequate basis for changing the standards as suggested.

Several comments suggested incorporating maintenance and operating requirements in the standards to enhance battery life and to insure that vehicle manufacturers provide conditions conducive to long battery life. DOE recognizes the importance of proper maintenance and vehicle operation as well as close communications and cooperation between the vehicle manufacturer and its component suppliers. However, these are considered by DOE to be normal responsibilities and concerns of a product manufacturer and not a proper area for extension of the minimum performance standards. The standards for battery life are, therefore, issued unchanged.

11. *Section 475.10(o) and 475.11(o)—Safety, crashworthiness, damageability, crash avoidance and hazards.* Several comments recommended that these standards be issued as proposed while others recommended specific changes discussed below.

One comment addressed paragraph (o)(1) and recommended that the standards require that (1) the batteries be restrained and prevented from leaking in event of a crash; (2) that future passive restraint requirements of Federal motor vehicle safety standards (FMVSS) 208 be met immediately; and (3) that side impact protection exceed

that required by the FMVSS. DOE has been in consultation with the National Highway Traffic Safety Administration of the Department of Transportation in developing and updating the DOE standards. DOE has determined that there is no significant potential for hazards from potential electrolyte spillage external to the passenger compartment and from the lack of battery retention because of the enclosures surrounding batteries and the present requirement (o)(2)(ii) of all battery material remaining outside the passenger compartment. Since expected use of vehicles in the DOE demonstration will not expose users to injury risks which are unusual compared to those associated with use of conventional vehicles, DOE does not consider it desirable to issue more stringent crashworthiness standards. While DOE is concerned with the safety of the demonstration vehicles, the Act does not require imposing stricter standards on electric and hybrid vehicle manufacturers than on manufacturers of conventional vehicles and the purpose of the demonstration program, as set forth in section 2 of the Act, is to encourage the substitution of electric and hybrid vehicles for internal combustion engine vehicles.

One comment requested clarification of the level of electrical isolation required in (o)(2)(i). The rules issued today have been clarified to include wording specifying that the electric propulsion circuit shall be electrically isolated from other conductive portions of the vehicle sufficiently to prevent hazards due to contacting any portion of the electric propulsion circuit while in contact with other portions of the vehicle.

A recommendation was received that (o)(2)(ii) be modified to permit a small amount of battery material intrusion into the passenger compartment. DOE does not concur with this suggestion. The required performance is presently being achieved by vehicles in the demonstration program with current technology and provides a substantial safety benefit.

A request was received to clarify how DOE applies the flame barrier provision for battery vents in (o)(2)(iii). The operation of the demonstration program has not provided any evidence of difficulties with this standard and, accordingly, DOE has not amended the provision. While verification testing in the past has relied on visual inspection of battery safety vents, it is DOE's intent to utilize the test procedure of the Battery Council International in future verification testing.

Several comments requested that the standards require an interlock to prevent vehicle movement while being charged. DOE is not revising the current standard since DOE considers it desirable to perserve the freedom for vehicle manufacturers to incorporate interlocks, as is commonly done, or to develop and apply means to safely charge vehicles through automatic connection and disconnection of the power source.

A comment stated that an audible reverse signal should be required. Although this may be desired for some off-road applications involving the use of either electric or conventional vehicles, it is considered unnecessary to require all demonstration vehicles to satisfy such a standard.

A comment was received recommending (1) setting a maximum achievable reverse speed; (2) requiring a forward-to-reverse interlock; and (3) requiring a rooftop flashing light which would operate when the vehicle was unable to keep up with traffic. DOE does not consider standards for reverse speed and a forward-to-reverse interlock necessary since no major hazard is apparent with reasonable operator care. DOE also rejects the slow vehicle flashers as unnecessary for vehicles meeting the performance standards as issued.

III. Final Regulations

The regulations are adopted as proposed except for modifications described above.

These performance standards only specify the minimum criteria for the selection of vehicles to be purchased or leased in fulfillment of contracts entered into following the effective date of these regulations for the demonstration projects to be conducted by DOE under section 7 of the Act. As part of its solicitation and selection process, DOE may specify varying priorities for increased performance levels and additional considerations within and among the designated categories in order to provide a broad spectrum of vehicles that best meet the needs of the demonstration program. Those vehicles meeting the minimum perfomance standards will be eligible to be considered for selection using criteria which may include user needs and preferences, reliability, durability, ease of maintenance, safety, passenger and cargo capability, energy use, noise, costs, warranties and other qualitative factors which will provide the project, to the extent practicable, pursuant to section 7(c)(1) of the Act, as amended, with demonstration vehicles which represent a cross section of available technologies and of actual or potential vehicle use.

The performance standards issued today are the first modification of the initial standards issued May 24, 1978 (43 FR 23498, May 30, 1978). These standards, as required by section 7(b)(3) of the Act, as amended, will be further revised periodically as the state of the art improves.

(Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976, Pub. L. 94–413, as amended by Department of Energy Act of 1978—Civilian Application, Pub. L. 95–238; Energy Reorganization Act of 1974, Pub. L. 93–438; Department of Energy Organization Act, Pub. L. 95–91)

In consideration of the foregoing, Chapter II of Title 10, Code of Federal Regulations, Part 475, is revised to read as set forth below.

Issued in Washington, D.C., February 5, 1980.

T. E. Stelson,

Assistant Secretary, Conservation and Solar Energy.

Chapter II of Title 10, Code of Federal Regulations, Part 475 is revised to read as follows:

PART 475—ELECTRIC AND HYBRID VEHICLE RESEARCH, DEVELOPMENT, AND DEMONSTRATION PROJECT

Subpart A—General Provisions

Sec.

475.1 Purpose and Scope
475.2 Definitions.
475.3 Test conditions and procedures.
475.4 Units.

Subpart B—Minimum Levels of Performance

475.10 Minimum levels of performance for personal-use vehicles.
475.11 Minimum levels of performance for commercial vehicles.

Authority: Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976, Pub. L. 94–413, as amended by Department of Energy Act of 1978—Civilian Applications, Pub. L. 95–238; Energy Reorganization Act of 1974, Pub. L. 93–438; Department of Energy Organization Act, Pub. L. 95–91.

Subpart A—General Provisions

§ 475.1 Purpose and scope.

This part contains performance standards for electric and hybrid vehicles required to be prescribed by the Department of Energy pursuant to section 7(b)(1) of the Act.

§ 475.2 Definitions.

As used in this part:

"Act" means the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976 (Pub. L. 94–413, 90 Stat. 1263 et seq.), as amended by

Department of Energy Act of 1978—Civilian Applications (Pub. L. 95–238; 92 Stat. 47, 91–94).

"Commercial vehicle" means a vehicle other than a personal-use vehicle.

"Electric vehicle" means a vehicle which is powered by an electric motor drawing current from rechargeable storage batteries, fuel cells, or other portable sources of electrical current, and which may include a nonelectrical source of power designed to charge batteries and components thereof.

"Hybrid vehicle" means a vehicle propelled by a combination of an electric motor and an internal combustion engine or other power source and components thereof.

"Personal-use vehicle" means a vehicle designed to carry ten persons or less, except a multipurpose passenger vehicle, motorcycle, truck, or trailer, as those terms are defined in 49 CFR 571.3.

"Vehicle" means an electric or hybid vehicle.

"Vital accessories" means headlights, taillights, windshield wipers, windshield defroster and defroster blowers. The heater blowers also shall be considered as vital accessories if the vehicle is equipped with a heater.

§ 475.3 Test conditions and procedures.

The conditions and procedures in Electric Vehicle Test Procedure—SAE J227a, as revised February 1976, of the Society of Automotive Engineers, shall be used to determine the levels of performance of vehicles for those categories for which minimum levels of performance are prescribed in Subpart B.

§ 475.4 Units.

The units and unit symbols and abbreviations used in this part are those of the International System of Units (Systeme International) or SI as established by the General Conference of Weights and Measures in 1960 and interpreted and modified for the United States pursuant to the U.S. Department of Commerce Notice on the Interpretation and Modification of the International System of Units for the United States (41 FR 54018, December 10, 1976).

Subpart B—Minimum Levels of Performance

§ 475.10 Minimum levels of performance for personal-use vehicles.

The following minimum levels of performance are required with respect to any personal-use vehicle purchased or leased in fulfillment of contracts entered into following the effective date of these regulations, pursuant to section 7(c) of the Act.

(a) *Acceleration.* The time required to accelerate from rest to 50 km/h shall not exceed 13.5s.

(b) *Gradeability at speed.* The grade which can be traversed up at 25 km/h shall be at least 10 percent.

(c) *Gradeability limit.* The grade on which the vehicle can start and climb for 20s either backward or forward shall be no less than 20 percent.

(d) *Forward speed capability.* The speed which can be maintained for 5 minutes shall be 80 km/h.

(e) *Range.* The distance which the vehicle can be operated with vital accessories on or equivalent, shall be:

(1) For an electric vehicle, at least 55 km on the SAE J227 a/C cycle, and

(2) For a hybrid vehicle, at least 200 km on the SAE J227 a/C cycle.

(f) *Battery recharge time.* The vehicle shall be capable of satisfying the range requirement of section 475.10(e) above, after being recharged for no more than 10 hours by use of an on-board charger. At the start of this recharge the vehicle shall have 80 percent discharged batteries as specified by the vehicle test conditions and procedures of section 475.3. The on-board charger shall be compatible with an electric power outlet of 110V or 220V AC, as specified by the vehicle manufacturer.

(g) *Recharge control.* The vehicle shall have an automatic recharge control which will meet the requirements of energy, life, and safety as such requirements are stated by these performance standards. This paragraph applies when on-board chargers are used and also when off-board chargers supplied by or specified by the vehicle manufacturer for recharge of the vehicle are used.

(h) *Energy consumption.* (1) For an electric vehicle, the maximum amount of nonelectrical energy consumed shall be that used for operation of the accessories only.

(2) For a hybrid vehicle, nonelectrical energy consumed shall not exceed 1.3 MJ/km and shall also not exceed 75 percent of total energy consumed for propulsion and vital accessories, based on being fully loaded on a driving schedule of 33 km on SAE J227 a/C cycle plus 33 km at 75 km/h (higher heating value of gasoline taken as 32.7 MJ/L) and with vital accessories on.

(i) *Battery life.* (1) The vehicle shall be capable of at least 75 percent of the range specified in § 475.10(e) after 12 months or 15,000 km of normal use, whichever occurs first.

(2) The vehicle shall be capable of 100 percent of the acceleration and gradeability specified in § 475.10 (a), (b), and (c), for all test conditions and procedures specified by § 475.3, for 12 months or 15,000 km or normal use, whichever occurs first.

(3) The batteries shall, if necessary, be repaired or replaced by the vehicle manufacturer at no cost to the user of the vehicle in order to meet requirements of (1) and (2) of § 475.10(i).

(j) *State-of-charge meter.* The vehicle shall have a state-of-charge meter for the propulsion battery system or other means of providing an indication of remaining range.

(k) *Odometer.* The vehicle shall have an odometer.

(l) *Passenger comfort heater.* The vehicle shall have the capability of having a passenger comfort heater installed at the option of the purchaser.

(m) *Documentation.* Adequate user manuals, maintenance (service) manual and parts lists shall be provided.

(n) *Emissions.* The vehicle shall comply with all applicable Federal emissions regulations for motor vehicles.

(o) *Safety, crashworthiness, damageability, crash avoidance and hazards.* (1) The vehicle shall comply with all applicable Federal motor vehicle safety standards as set forth in 49 CFR Part 571, unless a temporary exemption is obtained by the manufacturer from the Department of Transportation.

(2) Until the Department of Transportation issues regulations which cover the same subjects, the vehicle shall also have the following performance characteristics:

(i) The electric propulsion circuit shall be electrically isolated from other conductive portions of the vehicle sufficiently to prevent personal hazards due to contacting any portion of the electric propulsion circuit while in contact with other portions of the vehicle.

(ii) The vehicle shall be capable of complying with the performance requirements of Federal motor vehicle safety standards 208 and 301 with all battery materials remaining outside the passenger compartment.

(iii) Vehicles with battery vents shall have flame barrier provisions to inhibit battery explosions.

(iv) Ventilation shall be adequate within the battery compartment to maintain the concentration of hydrogen below 4 percent by volume during vehicle operation (including charging and maintenance).

(v) The vehicle shall have a device which provides for the positive disconnection of the battery and which is operable from the normal operator position.

(vi) The vehicle shall be capable of being parked for up to 8 hours in temperatures of −25°C to 50°C and subsequently operated, by moving forward under its own power, at any temperature within this temperature range without damage to the vehicle or hazard to persons.

§ 475.11 Minimum levels of performance for commercial vehicles.

The following minimum levels of performance are required with respect to any commercial vehicles purchased or leased in fulfillment of contracts entered into following the effective date of these regulations, pursuant to section 7(c) of the Act.

(a) *Acceleration.* The time required to accelerate from rest to 50 km/h shall not exceed 14s for vehicles with a payload carrying capability of less than or equal to 600 kg.

(b) *Gradeability at speed.* The grade which can be traversed up at 25 km/h shall be at least 10 percent.

(c) *Gradeability limit.* The grade which the vehicle can start and climb for 20s either backward or forward shall be no less than 20 percent.

(d) *Forward speed capability.* The speed which can be maintained for 5 minutes shall be 75 km/h.

(e) *Range.* The distance which the vehicle can be operated with vital accessories on or equivalent shall be:

(1) For an electric vehicle, at least 60 km on the SAE J227 a/B cycle, and

(2) For a hybrid vehicle, at least 200 km on the SAE J277 a/B cycle.

(f) *Battery recharge time.* The vehicle shall be capable of satisfying the range requirement of section 475.11(e) above, after being recharged for no more than 10 hours. At the start of this recharge, the vehicle shall have 80 percent discharged batteries as specified by the vehicle test conditions and procedures of section 475.3.

(g) *Recharge control.* The vehicle shall have an automatic recharge control which will meet the requirements of energy, life, and safety as such requirements are stated by these performance standards. This paragraph applies when on-board chargers are used and also when offboard chargers supplied by or specified by the vehicle manufacturer for recharge of the vehicle are used.

(h) *Energy Consumption.* (1) For an electric vehicle, the maximum amount of nonelectrical energy consumed shall be that used for operation of the accessories only.

(2) For a hybrid vehicle, nonelectrical energy consumed shall not exceed 9.8 kJ/kmkg of cargo and shall also not exceed 75 percent of total energy consumed for propulsion and vital accessories, based on being fully loaded on a driving schedule of 100 km on SAE J227 a/B cycle, the cargo not including the operator, and with vital accessories on.

(i) *Battery life.* (1) The vehicle shall be capable of at least 75 percent of the range specified in section 475.11(e) after 12 months or 15,000 km of normal use, whichever occurs first.

(2) The vehicle shall be capable of 100 percent of the acceleration and gradeability specified in section 475.11(a), (b), and (c), for all test conditions and procedures specified by section 475.3 for 12 months or 15,000 km or normal use, whichever occurs first.

(3) The batteries shall, if necessary, be repaired or replaced by the vehicle manufacturer at no cost to the user of the vehicle in order to meet requirements of (1) and (2) of section 475.11(i).

(j) *State-of-charge meter.* The vehicle shall have a state-of-charge meter for the propulsion battery system or other means of providing an indication of remaining range.

(k) *Odometer.* The vehicle shall have an odometer.

(l) *Passenger comfort heater.* The vehicle shall have the capability of having a passenger comfort heater installed at the option of the purchaser.

(m) *Documentation.* Adequate user manuals, maintenance (service) manuals and parts lists shall be provided.

(n) *Emissions.* The vehicle shall comply with all applicable Federal emissions regulations for motor vehicles.

(o) *Safety, crashworthiness, damageability, crash avoidance and hazards.* (1) The vehicle shall comply with all applicable Federal motor vehicle safety standards as set forth in 49 CFR Part 571, unless a temporary exemption is obtained by the manufacturer from the Department of Transportation.

(2) Until the Department of Transportation issues regulations which cover the same subjects, the vehicle shall also have the following performance characteristics:

(i) The electric propulsion circuit shall be electrically isolated from other conductive portions of the vehicle sufficiently to prevent personal hazards due to contacting any portion of the electric propulsion circuit while in contact with other portions of the vehicle.

(ii) The vehicle shall be capable of complying with ther performance requirements of Federal motor vehicle safety standards 208 and 301 with all battery materials remaining outside the passenger compartment.

(iii) Vehicles with battery vents shall have flame barrier provisions to inhibit battery explosions.

(iv) Ventilation shall be adequate within the battery compartment to maintain the concentration of hydrogen below 4 percent by volume during vehicle operation (including charging and maintenance).

(v) The vehicle shall have a device which provides for the positive disconnection of the battery and which is operable from the normal operator position.

(vi) The vehicle shall be capable of being parked for up to 8 hours in temperatures of −25°C to 50°C and subsequently operated, by moving forward under its own power, at any temperature within this temperature range without damage to the vehicle or hazard to persons.

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